

IN THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) A heater control apparatus configured and arranged to be operable by an alternating current having one of a plurality of frequencies, comprising:
~~and detecting~~ a zero-cross point detector configured to detect a zero-cross point of a voltage waveform of the alternating current ~~to be supplied from an electric power source coupled to supply power to a heater so as and~~ to generate a zero-cross signal based on the detected zero cross point; and
a frequency detector configured to detect an actual frequency of the alternating current of the power source based upon the zero-cross signal; and
a control part configured to control ~~controlling an~~ electric power supply being supplied to the heater ~~by using the zero-cross signal as a reference,~~
wherein, at a time of ~~tuning a power on~~ initially supplying power to the heater, the control part provides initial control based on a tentatively determined frequency of the alternating current ~~is tentatively determined~~ corresponding to one of the plurality of frequencies before-until the frequency ~~is detected~~ detector detects the actual frequency of the alternating current based upon the zero-cross signal so as to then control the electric power supply supplied to said heater based on the ~~tentatively determined frequency, and to control the electric power supply to said heater, after the actual~~ frequency of the alternating current is detected[[,]] ~~based on by the detected frequency~~ detector.

2. (Original) The heater control apparatus as claimed in claim 1, wherein said tentatively determined frequency is a highest frequency from among said plurality of frequencies.

3. (Original) The heater control apparatus as claimed in claim 1, wherein said plurality of frequencies are 50 Hz and 60 Hz, and said tentatively determined frequency is 60 Hz.

4. (Currently Amended) The heater control apparatus as claimed in claim 3, further comprising:

~~a zero-cross detection circuit which detects a zero-cross point of the voltage of the alternating current which is supplied to said heater from an alternating current power source part which accepts an alternating current of either 50 Hz or 60 Hz;~~

a switching circuit ~~which turns on and off~~ configured to switch supply of the electric power supply to said heater from said power source on and off[[:]], and

wherein the a control part which controls is further configured to control the on and off said switching of the switching circuit at a predetermined timing based on the zero-cross signal output from said zero-cross ~~detection circuit~~ detector,

~~wherein~~ said control part includes a setting circuit for setting a phase angle timer which determines a timing of turning on said switching circuit, ~~and a frequency detection circuit which detects the frequency of the alternating current supplied to said alternating current power source part from the zero-cross signal of the zero-cross point of the voltage of the alternating current by said zero-cross detection circuit generated by said zero-cross detection circuit[[:]]~~

at the time of ~~turning a power on~~ initially supplying power to the heater, the electric power ~~supply~~ supplied to said heater is controlled by setting a timer value of said phase angle timer in accordance with the tentatively determined frequency~~[[,]]~~, and

the electric power ~~supply~~ supplied to said heater ~~is controlled~~ is controlled ~~[[,]]~~ after the actual frequency of the alternating current is detected by said frequency detector ~~detection circuit~~ is controlled by setting the timer value of said phase angle timer in accordance with the detected actual frequency.

5. (Currently Amended) The heater control apparatus as claimed in claim 4, wherein said control part ~~continues~~ is configured to continue the control of the electric power ~~supply~~ supplied to said heater by setting the timer value of said phase angle timer based on the tentatively determined frequency when the actual frequency detected by said frequency ~~detection circuit~~ detector does not match any one of the plurality of frequencies.

6. (Currently Amended) The heater control apparatus as claimed in claim 5, wherein said control part ~~stores~~ is configured to store information in a nonvolatile memory~~[[,]]~~ ~~the information~~ indicating that the actual frequency detected by said frequency ~~detection circuit~~ detector does not match any one of the plurality of frequencies and the electric power ~~supply~~ supplied to said heater is continued by setting the timer value of said phase angle timer based on the tentatively determined frequency.

7. (Currently Amended) An image forming apparatus comprising: a heater control apparatus for controlling a heater; and

a fixation device equipped with said heater, wherein said heater control apparatus is configured and arranged to be operable by an alternating current having one of a plurality of frequencies, and includes,

~~detecting~~ a zero-cross point detector configured to detect a zero-cross point of a voltage waveform of the alternating current ~~to be supplied~~ from an electric power source coupled to supply power to a heater ~~so as~~ and to generate a zero-cross signal based on the detected zero cross point; and

a frequency detector configured to detect an actual frequency of the alternating current of the power source based upon the zero-cross signal; and

a control part configured to control ~~controlling an~~ electric power supply being supplied to the heater ~~by using the zero-cross signal as a reference,~~

wherein, at a time of ~~tuning a power on~~ initially supplying power to the heater, the control part provides initial control based on a tentatively determined frequency of the alternating current ~~is tentatively determined~~ corresponding to one of the plurality of frequencies before-until the frequency is ~~detected~~ detector detects the actual frequency of the alternating current based upon the zero-cross signal ~~so as to then~~ control the electric power supply supplied to said heater based on the ~~tentatively determined frequency, and to control the electric power supply to said heater, after the actual~~ frequency of the alternating current is detected[[,]] ~~based on by the detected~~ frequency detector.

8. (Original) The image forming apparatus as claimed in claim 7, wherein said tentatively determined frequency is a highest frequency from among said plurality of frequencies.

9. (Original) The image forming apparatus as claimed in claim 7, wherein said plurality of frequencies are 50 Hz and 60 Hz and said tentatively determined frequency is 60 Hz.

10. The image forming apparatus as claimed in claim 9, further comprising:

~~a zero-cross detection circuit which detects a zero-cross point of the voltage of the alternating current which is supplied to said heater from an alternating current power source part which accepts an alternating current of either 50 Hz or 60 Hz;~~

~~a switching circuit which turns on and off~~ configured to switch supply of the electric power supply to said heater from said power source on and off[[:]], and

wherein the a control part which controls is further configured to control the on and off ~~said~~ switching of the switching circuit at a predetermined timing based on the zero-cross signal output from said zero-cross ~~detection circuit~~ detector,

~~wherein~~ said control part includes a setting circuit for setting a phase angle timer which determines a timing of turning on said switching circuit, ~~and a frequency detection circuit which detects the frequency of the alternating current supplied to said alternating current power source part from the zero-cross signal of the zero-cross point of the voltage of the alternating current by said zero-cross detection circuit generated by said zero-cross detection circuit[[:]]~~

at the time of ~~turning a power on~~ initially supplying power to the heater, the electric power ~~supply~~ supplied to said heater is controlled by setting a timer value of said phase angle timer in accordance with the tentatively determined frequency[[:]], and

the electric power ~~supply~~ supplied to said heater is ~~controlled[[:]]~~ after the actual frequency of the alternating current is detected by said frequency detector ~~detection~~

~~circuit~~[[,]] is controlled by setting the timer value of said phase angle timer in accordance with the detected actual frequency.

11. (Currently Amended) The image forming apparatus as claimed in claim 10, wherein said control part ~~continues~~ is configured to continue the control of the electric power ~~supply~~ supplied to said heater by setting the timer value of said phase angle timer based on the tentatively determined frequency when the actual frequency detected by said frequency ~~detection circuit~~ detector does not match any one of the plurality of frequencies.

12. (Currently Amended) The image forming apparatus as claimed in claim 11, wherein said control part ~~stores~~ is configured to store information in a nonvolatile memory[[,]] ~~the information~~ indicating that the actual frequency detected by said frequency ~~detection circuit~~ detector does not match any one of the plurality of frequencies and the electric power supply supplied to said heater is continued by setting the timer value of said phase angle timer based on the tentatively determined frequency.

13. (Currently Amended) A heater control method of a heater configured and arranged to be operable by an alternating current having one of a plurality of frequencies, the heater control method comprising the steps of:

detecting a zero-cross point of a voltage waveform of the alternating current to be supplied to a heater so as to generate a zero-cross signal;

~~and controlling an electric power supply to the heater by using the zero-cross signal as a reference, the heater control method comprising the steps of~~[[,:]]

detecting ~~the~~ an actual frequency of the alternating current being supplied to the heater from the power supply based upon the zero-cross signal; and

controlling the electric power supply to the heater,

wherein the controlling step includes sub-steps of,

tentatively determining[[,]] ~~at a time of tuning a power on[[,]]~~ the frequency of the alternating current when power is initially supplied to the heater and before the actual frequency is detected in the frequency detecting step;

initially controlling the electric power supply to said heater based on the tentatively determined frequency before the actual frequency is detected in the frequency detecting step; and

controlling the electric power supply to said heater[[,]] after the frequency of the alternating current is detected[[,]] in said detecting step based on the detected actual frequency.

14. (Currently Amended) The heater control method as claimed in claim 13, ~~wherein~~ further including selecting[[,]] ~~as said tentatively determined frequency[[,]]~~ a highest frequency from among said plurality of frequencies as said tentatively determined frequency in the step of tentatively determining the frequency.

15. (Original) The heater control method as claimed in claim 14, wherein said plurality of frequencies are 50 Hz and 60 Hz, and, selecting 60 Hz as said tentatively determined frequency.

16. (Currently Amended) The heater control method as claimed in claim 15, wherein the step of initially controlling the electric power supply to said heater[[,]] ~~at the time of turning a power on[[,]]~~ by based on the tentatively determined frequency before the actual frequency is detected in the frequency detecting step includes setting a timer value of a phase

angle timer in accordance with the tentatively determined frequency, the phase angle timer determining a timing of turning on a switching circuit; and

the step of controlling the electric power supply to said heater[[,]] after the frequency of the alternating current is detected[[,]] in said detecting step based on the detected actual frequency by setting the timer value of said phase angle timer in accordance with the detected actual frequency.

17. (Currently Amended) The heater control method as claimed in claim 16, further comprising a step of continuing the control of the electric power supply to said heater by setting the timer value of said phase angle timer based on the tentatively determined frequency when the detected actual frequency does not match any one of the plurality of frequencies.

18. (Original) The heater control method as claimed in claim 17, further comprising a step of storing information in a nonvolatile memory, the information indicating that the frequency detected by said frequency detection circuit does not match any one of the plurality of frequencies and the electric power supply to said heater is continued by setting the timer value of said phase angle timer based on the tentatively determined frequency.

19. (New) A heater apparatus configured and arranged to be operable by an alternating current having one of a plurality of frequencies, comprising:

means for detecting zero-cross points of a voltage waveform of the alternating current from an electric power source coupled to supply electric power to a heater and for generating a zero-cross signal based on said detected zero-cross points;

frequency detecting means for detecting the actual frequency of the alternating current from the electric power source based upon the zero-cross signal; and

means for controlling electric power supplied to the heater,

wherein, the means for controlling provides initial control of the electric power supplied to the heater based on a tentatively determined frequency of the alternating current corresponding to one of the plurality of frequencies before an actual frequency is detected by the frequency detecting means and the means for controlling controls the electric power supplied to the heater based on the actual frequency detected by the frequency detecting means after the actual frequency is detected by the frequency detecting means.

20. (New) The heater control apparatus as claimed in claim 19, wherein said plurality of frequencies are 50 Hz and 60 Hz, and said tentatively determined frequency is 60 Hz.